

brushless d.c. motor, and further comprising a third bearing disposed beyond said second one of said bearings and proximate the second end of the conveyor roller for rotatably supporting the conveyor roller.

16. (Amended) The motor of claims 13 or 14, wherein the rotor housing is fastened to the conveyor roller by an interference fit.

23. (New) The motor of claim 13, wherein said stationary shaft extends only between said first one of the bearings and said second one of the bearings, which is a distance less than a distance between said first end and said second end of said conveyor roller.

Remarks

In the Office Action of October 23, 2002, there was an objection to the drawings as not showing elements 32 and 50 mentioned in the specification. The mention of element 32 has been cancelled by the amendment to the specification. It is believed that bearing 50 is already shown in Fig. 3 (copy attached). In view of these two matters, it appears that amendment of the drawings is not necessary.

The claims were rejected under 35 U.S.C. §112, second paragraph. A proposed amendment along the lines suggested by the Examiner has been made to claims 13 and 14.

As a result of the Office action, the Applicant requested and was granted a telephone interview on January 22. The interview summary record was delayed in being received until the Examiner faxed it on February 6, 2003, for which the undersigned expresses thanks. In fact, the interview was held on January 22 and not on January 29 as stated in the Office Interview Summary record, as shown by the time records of the undersigned attorney. Also present during the interview was Mr. Martin Piedl, an engineering representative of the assignee of the present invention and someone familiar with the technology of the patent application and the prior art.

The courtesies extended by the Examiner during the interview are gratefully acknowledged.

The interview summary record states that "the claimed language is not written to incorporate the shaft's features that are distinguished from the prior art, and does not recite the function of the rotor housing that would make the rotor casing significantly different from the prior art."

The issue of the motor shaft was a new way of distinguishing the prior art that first came up as a result of discussions during the interview. New claim 23 has been submitted to claim this feature.

From Applicant's perspective claim 14, involving three bearings, also distinguishes from the prior art, because it is not so much the shortness of the shaft that is important, but that the motor air gap and the roller are both supported even though the motor can be shorter than the roller. Further distinctions from the prior art were also discussed.

For example, with respect to claims 13, 14 and 16, it is discussed that the terms "contact fit" or "interference fit" are structural and not method limitations. The term "interference fit" is well understood in the art and relates to a condition where the outside dimension of the inner part is so large with respect to the clearance provided by the inside dimension of the outer part that the parts interfere and are therefore held together without separate fasteners.

Claims 13, 15 and 17 were rejected under 35 U.S.C. §103 (a) as being unpatentable over Syverson, U.S. Pat. No. 5,918,728 in view of Pellstring.

Claim 13 recites:

"further comprising a cylindrical metal rotor housing forming a part of the rotor for receiving the segments of permanent magnetic material and for supporting the shaft and the stator coils in a motor assembly;

"wherein said motor assembly, including said cylindrical metal rotor housing, is disposed inside of and secured to said roller to rotate with said roller;" (Emphasis supplied.)

Syverson does not show a separate housing inside the conveyor roller. Pellstring was cited as showing a separate housing for the motor inside of a spindle casing.

Pellstring represents quite a different type of apparatus

-- a spindle motor for a computer hard disk drive in which the a spindle hub is mounted over (sits on the shoulders of) a piece of iron for the rotor. The loads in this device are axial and parallel to the spindle. The spindle is in no way a conveyor roller that is designed to bear industrial loads in a direction transverse to the roller.

When Applicant mentioned Pellstring during the interview, the Examiner indicated that there might be other art in the dynamoelectric field showing a motor housing inside of another member.

It was emphasized during the interview that this invention relates to conveyor rollers, and the claims are limited to conveyor rollers. In that art, it has not been typical to assemble the motor with a separate housing inside the conveyor roller, and Syverson confirms this by omitting the separate rotor housing. This leads, however, to a difficult assembly process.

Applicant's claimed invention recites a structure that provides advantages in its assembly. The claim, however, is directed to a final structure and not to the method of assembly. The structure is nonobvious, because it has not been employed in the field of conveyor rollers.

Relative to claim 13/16, there is no disclosure of an interference fit in Pellstring. The spindle may be simply slipped over the back iron and fastened in place. This does not produce the an interference fit that results from forcing a rotor assembly into a conveyor roller.

It was discussed during the interview that a further difference involves the shaft of Applicant's claimed invention which does not extend the length of the conveyor roller as shown in Syverson. The language in claim 13 which distinguished the invention from the prior art was objected to under 35 USC 112, second paragraph. There would be no need for applicant to correct matters under 112, second paragraph, if those matters only recited the prior art. Applicant could simply delete the language. Applicant has retained the language in claim 13 and amended to cure the alleged deficiencies under 35 USC 112, second paragraph, because this language does distinguish from the prior art in a way that is

not suggested in the cited references. To further distinguish from this art, claim 23 is submitted to recite that the stationary shaft extends only between said first one of the bearings and said second one of the bearings, which is a distance less than a distance between said first end and said second end of said conveyor roller.

Claim 14 provides an arrangement with three bearings, where the motor can be substantially shorter than the conveyor roller. Claim 14 was rejected over a combination of Syverson, Pellstring and Shiba. Shiba et al., U.S. Pat. No. 5,534,805, was cited for showing a motor extending part way along the roller. The bearings in Shiba do not perform as recited in the amended claims.

As discussed during the interview, Fig. 2 of Shiba shows a shaft and stator 3 that are stationary, but only shows one bearing 7 on one side of the motor, and the motor housing is not fitted inside of the conveyor roller, in which case the bearing is really a bearing that is present to support the conveyor roller and not the motor. There is no second bearing on the other side of the motor to provide the two bearings of claim 13 or the three bearings of claim 14.

Fig. 3 of Shiba shows a construction in which the central shaft 16 is not stationary as in the claimed invention, but it rotates and drives the roller through a gearing arrangement that the present invention was designed to eliminate. The bearings for the rotor 5 do not function to support the conveyor roller, and the bearings 7 do not function to control the air gap in the motor as claimed. Despite the large number of bearings in Shiba, Fig. 3 it is a totally non-analogous construction to the claimed invention.

The amendment amended claims 13 and 14 to remove the rejection under 35 U.S.C. §112, second paragraph, relative to the recitation of the bearings. The amendment has also made claim 14 independent of claim 13. Based on this presentation during the interview claim 14 was indicated as allowable over the art. Claim 14 should be indicated as allowed in the next Office communication.

Claims 15 and 17-22 depend directly or indirectly from claims 13 and 14 and are allowable for at least the same

reasons as claims 13 and 14.

Conclusion

In view of the Amendment and Remarks, reconsideration of the application is respectfully requested. After the Amendment, claims 13-23 are now pending, and a Notice of Allowance for these claims is earnestly solicited.

Respectfully submitted,

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Amended Paragraphs and Claims Marked

Please amend the last paragraph on page 6 bridging to page 7 as follows:

(Amended) The shaft 18 extends outwardly from the roller so that it can be secured to the frame of the conveyor. The outer peripheral surface[s] of a [pair] bearing[s] 30 [and 32] at this end of the shaft [are] is affixed to the inner surface of the roller 14. The outer peripheral surface of another bearing 34, at the other end of the shaft 18, is also affixed to the inner surface of the roller 14. These bearings are all rotatably mounted on the shaft 18 and allow the permanent magnet 10 along with the roller 14 to which it is affixed to rotate relatively to the fixed shaft 18 while maintaining the air gap 19 between the inner surface of the magnets and the outer periphery of toothed member 16. Conductors 37 are disposed in a passageway 36 in the shaft 18, including three phase conductors to provide power to the stator coils 15 from an external power source.

IN THE CLAIMS:

Please amend claims 13, 14 and 16 as follows:

13. (Amended) A motor for driving a cylindrical conveyor roller that rotates around a stationary shaft, said conveyor roller having a first end and a second end, the motor comprising:

a cylindrical rotor disposed inside of and mounted to rotate with said cylindrical roller around said stationary shaft;

wherein said rotor is formed of a plurality of longitudinal segments of permanent magnetic material, wherein said segments alternate orientation of north-south magnetic polarity in a radial direction to produce flux in flux path loops connecting pairs of the longitudinal segments;

a plurality of stator coils mounted on said shaft for receiving current from an external power supply that commutates current in said stator coils;

wherein said motor is a brushless d.c. motor;

further comprising a cylindrical metal rotor housing forming a part of the rotor for receiving the segments of permanent magnetic material and for supporting the shaft and the stator coils in a motor assembly;

wherein said motor assembly, including said cylindrical metal rotor housing, is disposed inside of and secured to said roller [with a contact fit] to rotate with the roller;

wherein said motor is supported by two spaced apart bearings which space the rotor from the stator to form an air gap; and

wherein a first one of said bearings is proximate [one] the first end of the conveyor roller and wherein [the other] a second one of said bearings is [disposed part way along the length] spaced a distance away from said first one of said bearings to support the conveyor roller, while still providing an air gap for spacing the rotor from the stator.

14. (Amended) A motor for driving a cylindrical conveyor roller that rotates around a stationary shaft, said conveyor roller having a first end and a second end, the motor comprising:

a cylindrical rotor disposed inside of and mounted to rotate with said cylindrical roller around said stationary shaft;

wherein said rotor is formed of a plurality of longitudinal segments of permanent magnetic material, wherein said segments alternate orientation of north-south magnetic polarity in a radial direction to produce flux in flux path loops connecting pairs of the longitudinal segments;

a plurality of stator coils mounted on said shaft for receiving current from an external power supply that commutates current in said stator coils;

wherein said motor is a brushless d.c. motor;

further comprising a cylindrical metal rotor housing forming a part of the rotor for receiving the segments of permanent magnetic material and for supporting the shaft and the stator coils in a motor assembly;

wherein said motor assembly, including said cylindrical metal rotor housing, is disposed inside of and secured to said roller to rotate with the roller;

wherein said motor is supported by two spaced apart bearings which space the rotor from the stator to form an air gap; and

wherein a first one of said bearings is proximate the first end of the conveyor roller and wherein a second one of said bearings is spaced a distance away from said first one of said bearings to support the conveyor roller, while still providing an air gap for spacing the rotor from the stator, and

[The motor of claim 13,] wherein said conveyor roller extends beyond said second one of said bearings and to a greater length than the brushless d.c. motor, and further comprising a third bearing disposed [at an] beyond said second one of said bearings and proximate the second end of the conveyor roller [opposite the bearing proximate to one end of the conveyor roller] for rotatably supporting the conveyor roller.

16. (Amended) The motor of claims 13 or 14, wherein the rotor housing [contacts] is fastened to the conveyor roller [with a force] by an interference fit.